

NON-PUBLIC?: N
ACCESSION #: 9309080338
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Brunswick Steam Electric Plant, Unit 2 PAGE: 1 OF 4

DOCKET NUMBER: 05000324

TITLE: UNIT 2 SCRAM DURING MAIN TURBINE CONTROL VALVE TESTING
EVENT DATE: 02/02/92 LER #: 92-001-01 REPORT DATE: 09/02/93

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 79%

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR
SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: Jeanne F. McGowan, Regulatory COMPLIANCE: (919) 457-2136
Compliance Specialist

COMPONENT FAILURE DESCRIPTION:
CAUSE: B SYSTEM: TG COMPONENT: ACC/SEAL MANUFACTURER: P070

REPORTABLE NPRDS: Y

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On January 29, 1992, Unit 2 was operating at approximately 100% steady state power. An annunciator for low electrohydraulic (EHC) fluid pressure was received. EHC pressure swings occurred. Reactor power was reduced to about 85% power to close #4 turbine control valve (TCV) which reduced the EHC pressure swings. On February 2, 1992, reactor power was reduced to approximately 79% and TCV testing began. During #2 TCV testing, the Control Operator (CO) did not have time to reset the scram logic for the 'B1' trip (received as expected) before the 'A1' trip signal was received causing a reactor scram. Following the reactor scram, RCIC automatically initiated and injected. HPCI initiated but level recovered prior to injection. The cause of this event was nitrogen trapped in the Turbine Control Valve Fast Closure (TCVFC) line creating a pressure perturbation on the TCVFC Pressure Switch #1 (2-EHC-PSL-1756) causing it to trip. The gas side of an EHC accumulator was found to be

solid with EHC fluid. It is believed that a seal failure of the accumulators associated with this line allowed nitrogen to enter the EHC fluid. The accumulator seal failure is attributed to excessive cycling which began after installation of the partial arc conversion modification during the last Unit 2 refueling outage. General Electric and Carolina Power & Light are investigating the cause and developing a plan for corrective action. Until implementation of the corrective action, reactor power was reduced to decrease the EHC system oscillations. The EHC accumulators were rebuilt. During the scram recovery the CO was unable to reset the 'A' Reactor Feed Pump (RFP) turbine due to a failed reset relay coil in the RFP reset logic. The 'A' RFP also had a bound pump shaft assembly due to failure of wear ring cap screws. The safety significance of this event was minimal. Safety systems functioned as designed. Another similar event was reported in LER 1-90-017 (SCRAM during TCV/TSV testing due to procedural and switch problems). The cause classification for this event per the criteria of NUREG-1022 is Design, Manufacturing, Construction/Installation.

END OF ABSTRACT

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TITLE

UNIT 2 SCRAM DURING MAIN TURBINE CONTROL VALVE TESTING

INITIAL CONDITIONS

On February 1, 1992, unit 2 was operating at 87% power. Periodic Test (PT) 40.2.5, Turbine Control Valve and Extraction Steam Stop Valve Testing, was scheduled to be performed during the shift. On February 2, 1992, at 0313 hours, the Control Operator commenced a power reduction to 80% to perform the weekly valve testing. A briefing was held and at 0345 hours the valve testing commenced. The High Pressure Coolant Injection System (HPCI) and the Reactor Core Isolation Cooling System (RCIC) were operable and in standby.

EVENT NARRATIVE

On January 29, 1992, Unit 2 was operating at approximately 100% power. An annunciator for low EHC fluid pressure was received. EHC pressure swings occurred and reactor power was reduced to approximately 85% to close #4 TCV which reduced the EHC pressure swings.

The 4 TCVs had experienced oscillations during power ascension to 100%; after the Unit 2 refueling outage. A plant modification had been installed

to convert the Unit 2 High Pressure (HP) turbine from a full arc to a partial arc valve admission. During the investigation of the control valve oscillations, the lead/lag potentiometers in the pressure regulator control loops were found at zero (0). The system was aligned after installation of the Partial Arc Conversion modification. Per the lineup instructions, lead/lag potentiometers are moved to zero (0) from their operational settings at the start of pressure control adjustments. Upon completion of the pressure control adjustments they are to be returned to their "as-found" settings. The lead/lag potentiometers were not returned to the required "as-found" positions upon completion of the pressure control section of the line-up instructions. Unit 2 was shutdown to correct the potentiometer settings. The unit was returned to 100% power after the adjustments were made.

After restart, the valves continued to oscillate causing steam line pressure swings. The EHC pressure regulators began to alternately control the valve demand signals due to the pressure swings. Reactor power was reduced due to scram potential of the unstable pressure regulators. Based on the manufacturers recommendations, a bias adjustment was made to separate the control functions of the pressure regulators, allowing the backup pressure regulator to control the valve demand signals. This did provide better valve stability; however, after approximately seven days of 100% power operation the valve oscillations became larger and the EHC hydraulic pressure was observed to be moving greater than 150 psi. Reactor power was reduced to 85% while a root cause determination was made. Based on a recommendation from the manufacturer, the hydraulic accumulators were tested and it was discovered that leakage past the seals had resulted in the accumulators being filled with EHC fluid. The reduction in mechanical dampening from the leakage into the gas end of the accumulators was corrected by depressurizing the gas end and recharging it to the correct pressure in accordance with PT 33.1, EHC Accumulator Precharge Check, on February 1, 1992. The unit was expected to return to 100% power after performing control valve testing to assure correct mechanical response of the accumulators.

On February 2, 1992, at 0313 hours, the Control Operator commenced reactor power reduction to 80% to perform PT 40.2.5, Turbine Control Valve and Extraction Steam Stop Valve Testing. A briefing was held and at 0345 hours, the valve testing commenced. At 0509 hours, while

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testing the #2 TCV, a reactor scram occurred due to the actuation of an EHC Reactor Protection System (RPS) pressure switch (2-EHC-PSL-1756). Following the reactor scram, RCIC automatically initiated and injected. HPCI initiated but level recovered prior to allowing injection.

Preliminary investigation into this event revealed that the accumulator piston seals were subjected to excessive cyclic wear due to the hydraulic oscillations in the EHC system. The EHC Accumulators were rebuilt and placed back in service. The unit was returned to 82% power and evaluations of the accumulator seal failure continued. The unit was to remain at 82% power to minimize control valve oscillations and until the root cause could be determined and the corrective actions implemented. The unit remained at 82% power until both units were shutdown in April due to Diesel Generator Building seismic concerns.

CAUSE OF EVENT

The cause of the event was the excessive cycling of the turbine control valves. This caused the failure of the EHC Accumulator seals. The seal failure allowed nitrogen into the EHC lines, causing a pressure perturbation on the TCVFC Pressure Switch No. 1 (2-EHC-PSL-1756). This perturbation caused the opening of the TCVFC Pressure Switch No. 1 during testing of TCV #2. Extensive bench testing of the TCVFC Pressure Switch No. 1 showed no defects or unusual sensitivity to pressure perturbations. It was concluded that the pressure seen by the switch did drop into the trip setpoint range and the switch did react to that pressure by opening.

Following the scram on February 2, 1992, both of the EHC Accumulators were disassembled. Removal of the piston revealed that the piston seal in both accumulators had failed. Both seals had significant deterioration as indicated by excessive pitting. The failure of the seals were due to the pressure oscillations during the period from January 5 to February 2, 1992. This was due to the instability experienced in the EHC system pressure regulator as seen after the conversion from full arc-1 admission to partial arc-2 admission. Initially, hydraulic pressure oscillations in the order of approximately 70-100 psi were seen. After electronic adjustment to the pressure regulator, hydraulic pressure oscillations of approximately 25-50 psi were seen. The frequency range of these oscillations was 0.5 - 1.0 Hz. Typical hydraulic accumulator piston seals have a life of $1 - 2 \times 10^6$ cycles. Based on the time period and frequency of the hydraulic pressure oscillations, the EHC accumulators experienced in excess of $1 \times 10^{*6}$ cycles.

As part of the Partial Arc Conversion Modification, new valve curves were used to permit operation for partial arc - 2 admission. The investigation of the failed EHC Accumulator seals revealed that the valve curves were designed for a reactor output of 105%. The power uprate modification on the reactor had not been performed and the reactor output was 100% rather than 105%. This caused the new valve curves to be inaccurate for the

present reactor operation. The resulting turbine instability caused turbine control valve oscillations and the EHC Accumulator seal failure.

CORRECTIVE ACTIONS

Corrective actions included the following:

1. The EHC hydraulic accumulators A and B were disassembled. The inner cylinder walls were checked for nicks and light scoring and any indications were removed with crocus cloth. All "O" rings, teflon rings, and piston seals were replaced. The

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accumulators were reassembled and placed back in operation.

2. The accumulator testing frequency was increased to verify accumulator integrity. The increased frequency continued until the unit was shutdown in April, 1992.

3. Reactor power remained at a lower level to prevent the opening of Tcv #4 which resulted in stable unit operation and eliminated abnormal EHC pressure oscillations. The reduced power level continued until the unit was shutdown in April, 1992.

4. The causes for errors made during the design and installation phases of the partial arc conversion modification were studied. Lessons learned were incorporated into redesign and repair activity. After the April 1992 shutdown, the decision was made by plant management to return the Turbine to partial arc - 3 admission. This decision was based on the stable operation of the unit during the first ten years when the unit was in partial arc -3 admission turbine operation. The modification was performed and the unit was able to achieve 1004; operation without the previous oscillations experienced in partial arc - 2 admission.

SAFETY ASSESSMENT

The safety significance of this event was minimal. Safety systems functioned as designed. HPCI and RCIC initiated as required with RCIC injecting to restore vessel inventory. HPCI did not inject due to level recovery prior to the HPCI injection valve receiving an open signal.

PREVIOUS SIMILAR EVENTS

A previous similar event was reported in LER 1-90-017, Scram during

TCV/TSV testing due to procedural and switch problems.

EIIS COMPONENT IDENTIFICATION

System/Component EIIS Code

ELECTROHYDRAULIC SYSTEM TG
ACCUMULATOR/SEAL ACC/SEAL

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CP&L

Carolina Power & Light Company

Brunswick Nuclear Plant
P. O. Box 10429
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September 3, 1993

FILE: B09-13510C 10CFR50.73
SERIAL: BSEP-93-0137

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

BRUNSWICK NUCLEAR PLANT UNIT 2
DOCKET NO. 50-324
LICENSE NO. DRP-62
SUPPLEMENTAL LICENSEE EVENT REPORT 2-92-001-01

Gentlemen:

In accordance with Title 10 of the Code of Federal Regulations, the enclosed Supplemental Licensee Event Report is submitted. The original report fulfilled the requirement for a written report within thirty (30) days of a reportable occurrence and was submitted in accordance with the format set forth in NUREG-1022, September 1983.

Supplemental Licensee Event Report 2-92-001-01 was mailed on September 1, 1993. Due to the inadvertent omission of the report date on form OMB 3150-0104 please disregard that report and replace it with this supplement.

Very truly yours,

C. C. Warren, Plant Manager Unit 2
Brunswick Nuclear Plant

JFM/jfm

Enclosure

cc: Mr. S. D. Ebnetter
Mr. P. D. Milano
BNP NRC Resident Office

*** END OF DOCUMENT ***
